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Diffraction: wave dynamics near the break-up of an underwater bubble LIPENG LAI, SAMUEL D. OBERDICK, WENDY W. ZHANG, University of Chicago — Recent studies show that the final form of bubble break-up is dominated by a memory of initial asymmetries, in contrast to the idea that the break-up dynamics inevitably evolves towards a universal form independent of boundary and initial conditions. Specifically, when the neck of the submerged bubble is distorted from cylindrical symmetry, vibrations in the neck cross-section about the average contraction are excited. These vibrations, which correspond to standing waves on the air-water interface, persist until break-up. As a result, the break-up dynamics is both asymmetric and dependent on the initial distortion. Previous works analyzed the situation where the initial distortion is dominated by a single vibrational mode. They found that the final dynamics continues to be dominated by the initial mode. Nonlinear interactions, which create new modes and change the relative amplitudes of the different modes present, are expected to have a more pronounced role in the diffraction limit, when many vibrational modes are present. Here we examine the break-up dynamics when a large number of vibrational modes are present. We use a boundary integral simulation to track the how the cross-section of the bubble neck evolves over time. The results are compared against predictions from linear stability.

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